

## CLAIMS

The invention claimed is:

1. A physical vapor deposition target comprising:  
greater than or equal to 90 atomic percent copper;  
a first added element; and  
a second added element, the first and second added elements each being selected from the group consisting of Ag, Al, As, Au, B, Be, Ca, Cd, Co, Cr, Fe, Ga, Ge, Hf, Hg, In, Ir, Li, Mg, Mn, Nb, Ni, Pb, Pd, Pt, Sb, Sc, Si, Sn, Ta, Te, Ti, V, W, Zn, and Zr.
2. The physical vapor deposition target of claim 1 wherein a total combined amount of the first and second added elements present in the target is from at least 100 ppm to less than about 10 atomic %.
3. The physical vapor deposition target of claim 1 wherein the target consists essentially of copper and the first and second added elements.
4. The physical vapor deposition target of claim 1 wherein the first and second added elements are each present in the target at 0.5 atomic percent.
5. The physical vapor deposition target of claim 1 wherein the first and second added elements are each present in the target at 0.3 atomic percent.
6. The physical vapor deposition target of claim 1 wherein the first and second added elements are present in the target in equivalent atomic percent relative to each other.
7. The physical vapor deposition target of claim 6 wherein the first added element is Sn, or Ag.
8. The physical vapor deposition target of claim 7 wherein the second added element is Al, Zn, In, or Ti.

9. The physical vapor deposition target of claim 1 further comprising a third added element selected from the group consisting of Ag, Al, As, Au, B, Be, Ca, Cd, Co, Cr, Fe, Ga, Ge, Hf, Hg, In, Ir, Li, Mg, Mn, Nb, Ni, Pb, Pd, Pt, Sb, Sc, Si, Sn, Ta, Te, Ti, V, W, Zn, and Zr.
10. The physical vapor deposition target of claim 9 wherein the target consists essentially of copper and the first, second and third added elements.
11. A physical vapor deposition target comprising:  
copper; and  
at least two elements selected from the group consisting of Ag, Al, As, Au, B, Be, Ca, Cd, Co, Cr, Fe, Ga, Ge, Hf, Hg, In, Ir, Li, Mg, Mn, Nb, Ni, Pb, Pd, Pt, Sb, Sc, Si, Sn, Ta, Te, Ti, V, W, Zn, and Zr, a total amount of the at least two elements present in the target being from at least 100 ppm to less than about 1 atomic %.
12. The physical vapor deposition target of claim 11 wherein the total amount of the at least two elements is from about 1000 ppm to less than about 2 atomic percent.
13. The physical vapor deposition target of claim 11 wherein the at least two elements include one or more of Sn, Al, In, Ti, Ag and Zn.
14. The physical vapor deposition target of claim 11 wherein the target comprises a ternary mixture of copper and two additional elements.
15. The physical vapor deposition target of claim 14 wherein the target consists essentially of the ternary mixture.
16. The physical vapor deposition target of claim 14 wherein the ternary mixture is a ternary alloy.
17. An interconnect comprising a mixture of copper and two or more elements selected from the group consisting of Ag, Al, As, Au, B, Be, Ca, Cd, Co, Cr, Fe, Ga, Ge, Hf, Hg, In, Ir, Li, Mg, Mn, Nb, Ni, Pb, Pd, Pt, Sb, Sc, Si, Sn, Ta, Te, Ti, V, W, Zn, and Zr, a total amount of the at least two elements present in the interconnect being from at least 100 ppm to less than about 10 atomic %.

18. The interconnect of claim 17 wherein the two or more elements includes a first element and a second element, the first and second elements being present in atomic equivalent amounts within the mixture relative to each other.

19. The interconnect of claim 18 wherein the first and second elements are each present in the mixture at 0.5 atomic percent.

20. The interconnect of claim 18 wherein the first and second elements are each present in the mixture at 0.3 atomic percent.

21. A thin film comprising a mixture of copper and two or more elements selected from the group consisting of Ag, Al, As, Au, B, Be, Ca, Cd, Co, Cr, Fe, Ga, Ge, Hf, Hg, In, Ir, Li, Mg, Mn, Nb, Ni, Pb, Pd, Pt, Sb, Sc, Si, Sn, Ta, Te, Ti, V, W, Zn, and Zr, a total amount of the at least two elements present in the thin film being from at least 100 ppm to less than about 10 atomic %.

22. The thin film of claim 21 wherein the mixture is a ternary mixture.

23. The thin film of claim 21 wherein the mixture comprises a first element selected from Sn and Ag, and a second element selected from In, Zn, Ti and Al.

24. The thin film of claim 23 wherein the first and second elements are present in the mixture at an equivalent atomic percent relative to each other.

25. A method of forming a copper target, comprising:  
forming a mixture comprising copper and two or more elements selected from the group consisting of Ag, Al, As, Au, B, Be, Ca, Cd, Co, Cr, Fe, Ga, Ge, Hf, Hg, In, Ir, Li, Mg, Mn, Nb, Ni, Pb, Pd, Pt, Sb, Sc, Si, Sn, Ta, Te, Ti, V, W, Zn, and Zr, a total amount of the at least two elements present in the mixture being from at least 100 ppm to less than about 10 atomic %;

casting the mixture by melting and subsequent cooling to form a billet;  
and

working the billet to form a target, the working comprising one or more of equal channel angular extrusion, and thermomechanical processing.

26. The method of claim 25 wherein the mixture is a ternary mixture.

27. The method of claim 25 wherein the mixture consists essentially of copper and the at least two elements.

28. The method of claim 25 wherein the two or more elements includes a first element and a second element, the first and second elements being present in atomic equivalent amounts within the mixture relative to each other.

29. The method of claim 25 wherein the mixture is present in the target in an alloy form.

30. The method of claim 25 wherein the target is monolithic.

31. The method of claim 25 wherein the forming the target comprises bonding the target to a backing plate.